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Medium-Power Plastic NPN Silicon Transistors

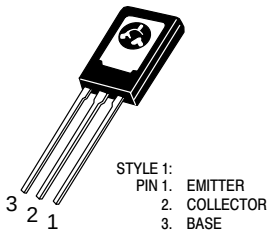
2N4921 thru 2N4923 *

*ON Semiconductor Preferred Device

. . . designed for driver circuits, switching, and amplifier applications. These high–performance plastic devices feature:

- Low Saturation Voltage — $V_{CE(sat)}$ = 0.6 Vdc (Max) @ I_C = 1.0 Amp
- Excellent Power Dissipation Due to Thermopad Construction — P_D = 30 W @ T_C = 25°C
- Excellent Safe Operating Area
- Gain Specified to I_C = 1.0 Amp
- Complement to PNP 2N4918, 2N4919, 2N4920

1 AMPERE GENERAL–PURPOSE POWER TRANSISTORS 40–80 VOLTS 30 WATTS



CASE 77–09 TO–225AA TYPE

***MAXIMUM RATINGS**

Rating	Symbol	2N4921	2N4922	2N4923	Unit
Collector–Emitter Voltage	V_{CEO}	40	60	80	Vdc
Collector–Base Voltage	V_{CB}	40	60	80	Vdc
Emitter–Base Voltage	V_{EB}	5.0			Vdc
Collector Current — Continuous (1)	I_C	1.0 3.0			Adc
Base Current — Continuous	I_B	1.0			Adc
Total Power Dissipation @ T_C = 25°C Derate above 25°C	P_D	30 0.24			Watts W/°C
Operating & Storage Junction Temperature Range	T_J, T_{stg}	–65 to +150			°C

THERMAL CHARACTERISTICS (2)

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	θ_{JC}	4.16	°C/W

(1) The 1.0 Amp maximum I_C value is based upon JEDEC current gain requirements. The 3.0 Amp maximum value is based upon actual current handling capability of the device (see Figures 5 and 6).

(2) Recommend use of thermal compound for lowest thermal resistance.

*Indicates JEDEC Registered Data.

Preferred devices are ON Semiconductor recommended choices for future use and best overall value.

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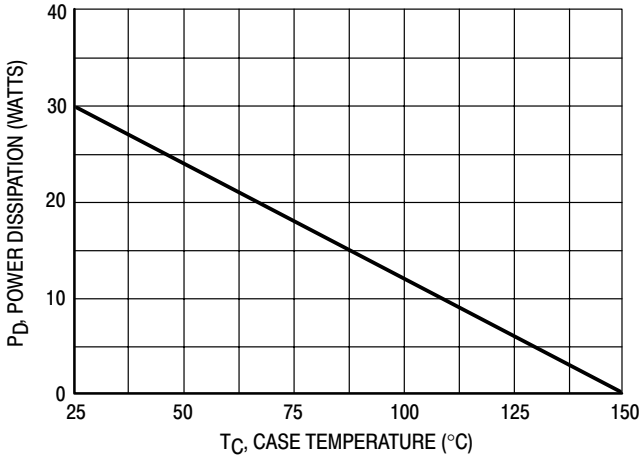


Figure 1. Power Derating

Safe Area Curves are indicated by Figure 5. All limits are applicable and must be observed.

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Characteristic		Symbol	Min	Max	Unit
OFF CHARACTERISTICS					
Collector–Emitter Sustaining Voltage (3) (I_C = 0.1 Adc, I_B = 0)	2N4921 2N4922 2N4923	$V_{CEO(sus)}$	 40 60 80	 — — —	Vdc
Collector Cutoff Current (V_{CE} = 20 Vdc, I_B = 0) (V_{CE} = 30 Vdc, I_B = 0) (V_{CE} = 40 Vdc, I_B = 0)	 2N4921 2N4922 2N4923	I_{CEO}	 — — —	 0.5 0.5 0.5	mAdc
Collector Cutoff Current (V_{CE} = Rated V_{CEO}, $V_{EB(off)}$ = 1.5 Vdc) (V_{CE} = Rated V_{CEO}, $V_{EB(off)}$ = 1.5 Vdc, T_C = 125°C		I_{CEX}	 — —	 0.1 0.5	mAdc
Collector Cutoff Current (V_{CB} = Rated V_{CB}, I_E = 0)		I_{CBO}	—	0.1	mAdc
Emitter Cutoff Current (V_{EB} = 5.0 Vdc, I_C = 0)		I_{EBO}	—	1.0	mAdc
ON CHARACTERISTICS					
DC Current Gain (3) (I_C = 50 mAdc, V_{CE} = 1.0 Vdc) (I_C = 500 mAdc, V_{CE} = 1.0 Vdc) (I_C = 1.0 Adc, V_{CE} = 1.0 Vdc)		h_{FE}	 40 30 10	 — 150 —	—
Collector–Emitter Saturation Voltage (3) (I_C = 1.0 Adc, I_B = 0.1 Adc)		$V_{CE(sat)}$	—	0.6	Vdc
Base–Emitter Saturation Voltage (3) (I_C = 1.0 Adc, I_B = 0.1 Adc)		$V_{BE(sat)}$	—	1.3	Vdc
Base–Emitter On Voltage (3) (I_C = 1.0 Adc, V_{CE} = 1.0 Vdc)		$V_{BE(on)}$	—	1.3	Vdc
SMALL–SIGNAL CHARACTERISTICS					
Current–Gain — Bandwidth Product (I_C = 250 mAdc, V_{CE} = 10 Vdc, f = 1.0 MHz)		f_T	3.0	—	MHz
Output Capacitance (V_{CB} = 10 Vdc, I_E = 0, f = 100 kHz)		C_{ob}	—	100	pF
Small–Signal Current Gain (I_C = 250 mAdc, V_{CE} = 10 Vdc, f = 1.0 kHz)		h_{fe}	25	—	—

(3) Pulse Test: PW ≈ 300 μs, Duty Cycle ≈ 2.0%.
*Indicates JEDEC Registered Data.

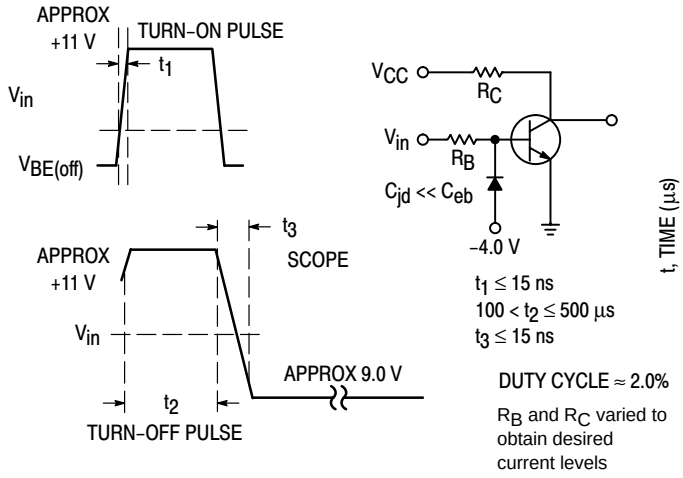


Figure 2. Switching Time Equivalent Circuit

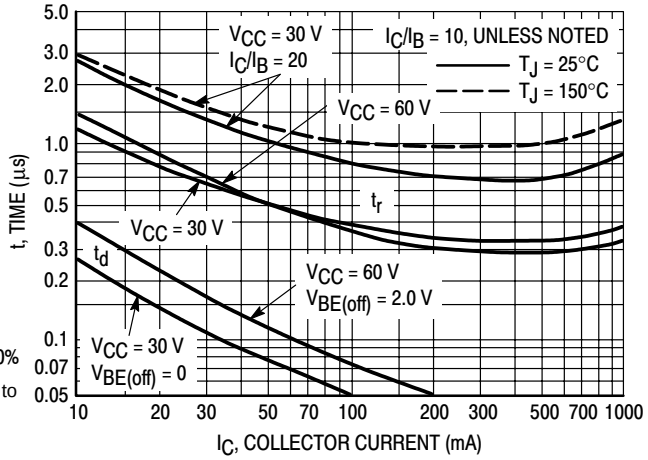


Figure 3. Turn–On Time

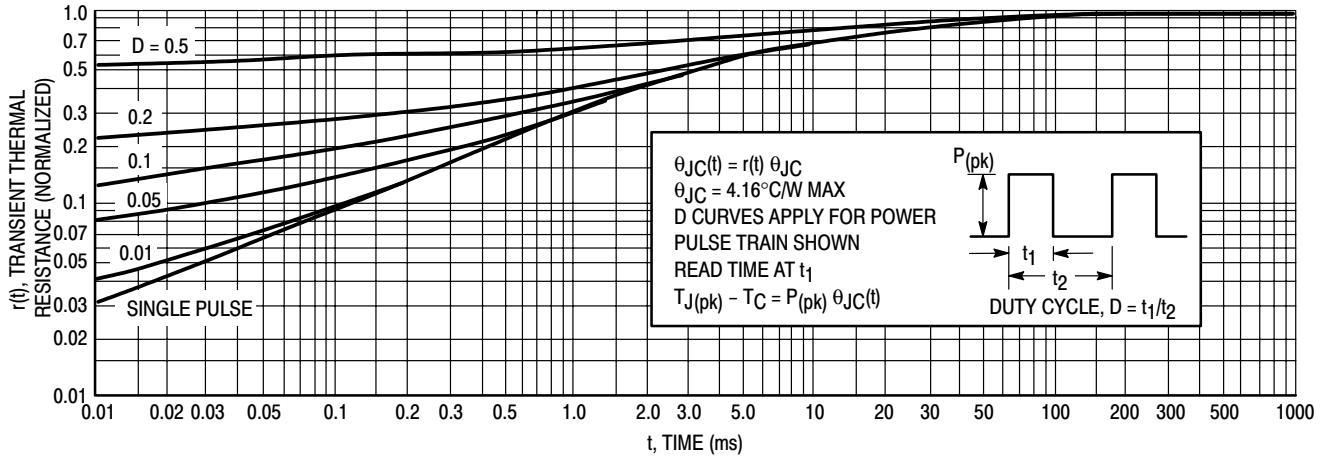


Figure 4. Thermal Response

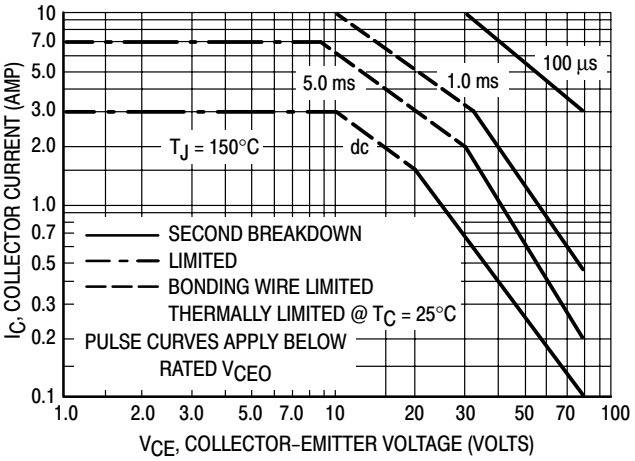


Figure 5. Active−Region Safe Operating Area

There are two limitations on the power handling ability of a transistor: average junction temperature and second breakdown. Safe operating area curves indicate $I_C - V_{CE}$ operation i.e., the transistor must not be subjected to greater dissipation than the curves indicate.

The data of Figure 5 is based on $T_{J(pk)} = 150°C$; T_C is variable depending on conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided $T_{J(pk)} \leq 150°C$. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

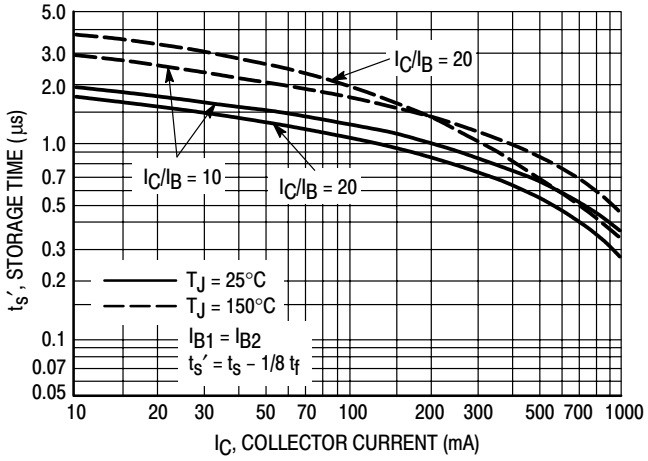


Figure 6. Storage Time

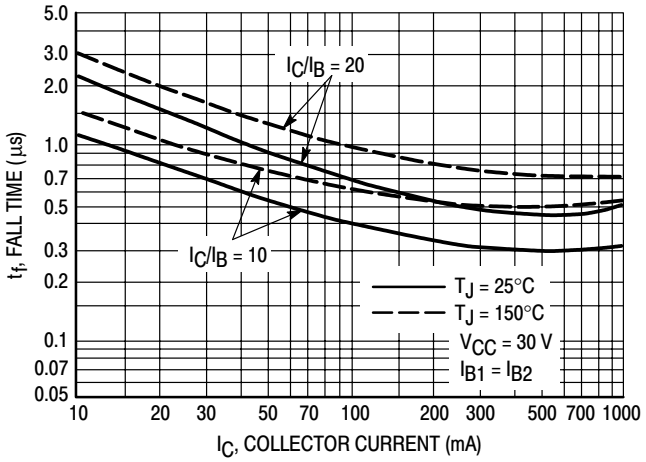


Figure 7. Fall Time

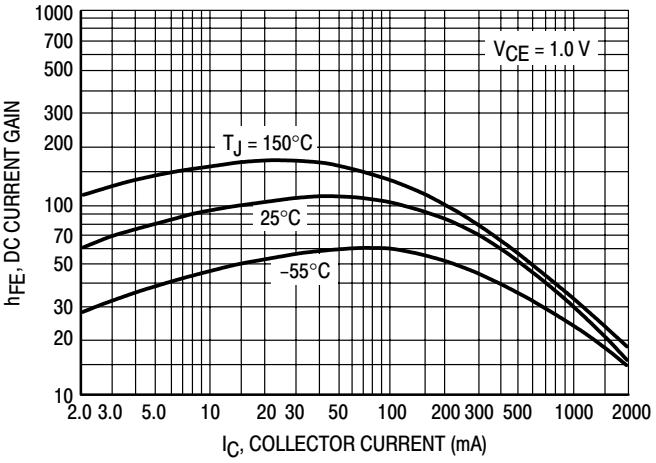


Figure 8. Current Gain

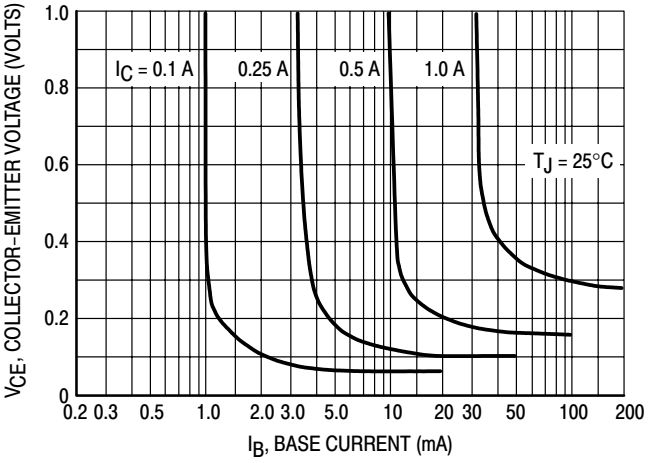


Figure 9. Collector Saturation Region

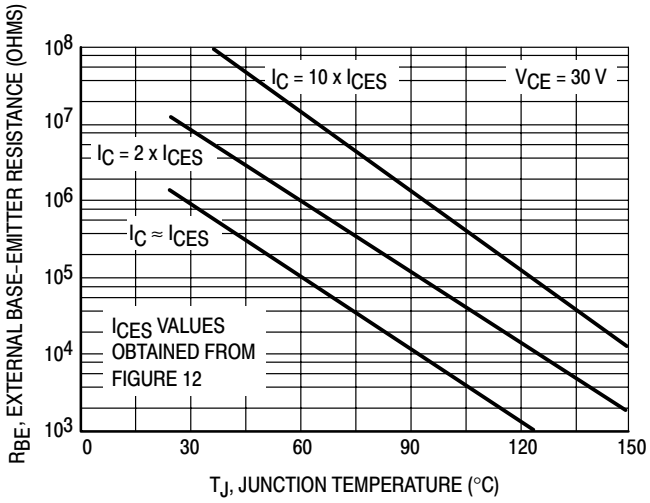

I_C = 10 x I_{CES}
V_{CE} = 30 V
I_C = 2 x I_{CES}
$I_C \approx I_{CES}$
I_{CES} VALUES OBTAINED FROM FIGURE 12
R_{BE}, EXTERNAL BASE−EMITTER RESISTANCE (OHMS)
T_J, JUNCTION TEMPERATURE (°C)

Figure 10. Effects of Base−Emitter Resistance

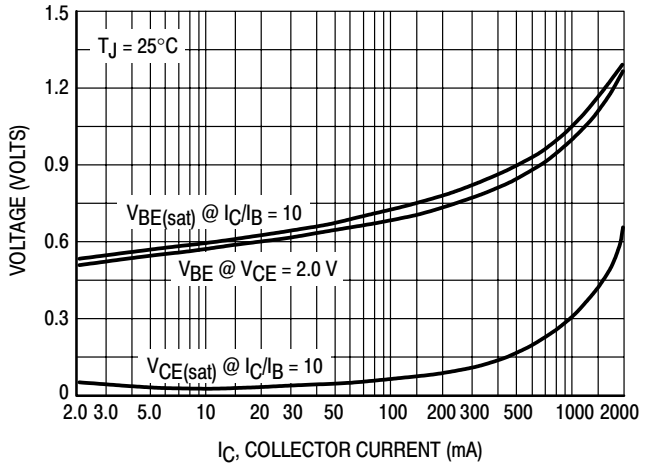


Figure 11. “On” Voltage

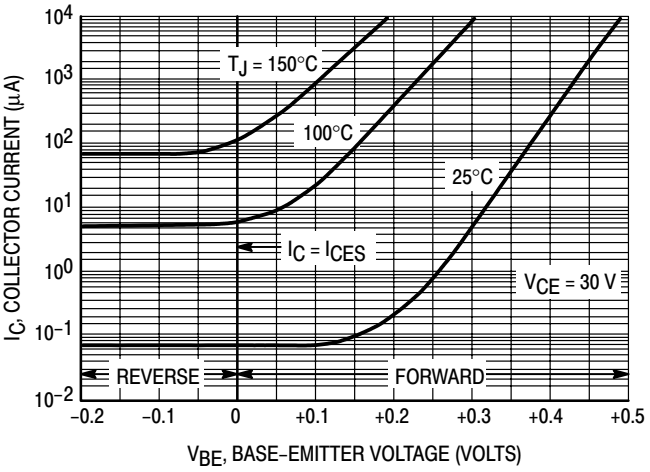


Figure 12. Collector Cut−Off Region

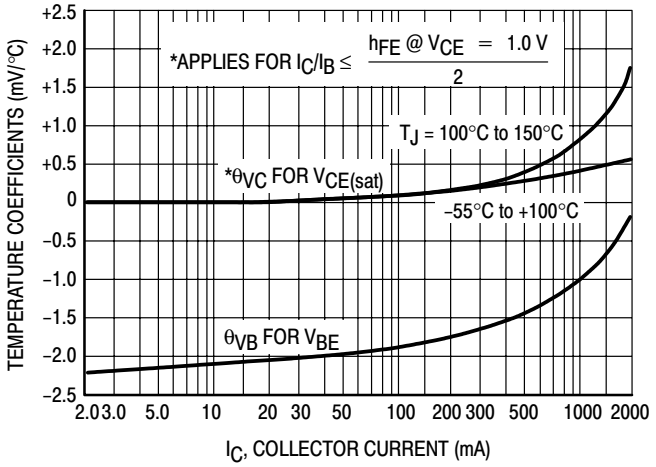
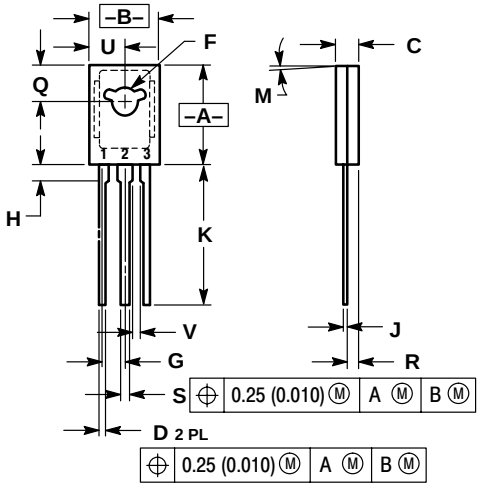

*APPLIES FOR $I_C/I_B \leq \frac{h_{FE} @ V_{CE} = 1.0 V}{2}$
T_J = 100°C to 150°C
*θ_{VC} FOR $V_{CE(sat)}$
−55°C to +100°C
θ_{VB} FOR V_{BE}
TEMPERATURE COEFFICIENTS (mV/°C)
I_C, COLLECTOR CURRENT (mA)

Figure 13. Temperature Coefficients

PACKAGE DIMENSIONS

CASE 77–08
TO–225AA TYPE
ISSUE V



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.425	0.435	10.80	11.04
B	0.295	0.305	7.50	7.74
C	0.095	0.105	2.42	2.66
D	0.020	0.026	0.51	0.66
F	0.115	0.130	2.93	3.30
G	0.094 BSC		2.39 BSC	
H	0.050	0.095	1.27	2.41
J	0.015	0.025	0.39	0.63
K	0.575	0.655	14.61	16.63
M	5° TYP		5° TYP	
Q	0.148	0.158	3.76	4.01
R	0.045	0.055	1.15	1.39
S	0.025	0.035	0.64	0.88
U	0.145	0.155	3.69	3.93
V	0.040	---	1.02	---

STYLE 1:
PIN 1. EMITTER
2. COLLECTOR
3. BASE

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